City of Columbia

TMDL Monitoring and Assessment Plan

Contents:

Acronyms:

40 CFR 136	Code of Federal Regulations Title 40 Part 136
MS4	Municipal Separate Storm Sewer System
POC	Pollutant of Concern
SCDHEC	South Carolina Department of Health and Environmental Control
TMDL	Total Maximum Daily Load
WLA	Waste Load Allocation
WQMS	Water Quality Monitoring Station

1 Introduction

This document outlines the City of Columbia's (the City's) current plan for monitoring the water quality of impaired waters for which the South Carolina Department of Health and Environmental Control (SCDHEC) has issued Total Maximum Daily Load (TMDL) requirements. This plan has been set out with a goal of establishing baseline pollutant loads for the impaired water bodies to which the City's Municipal Separate Storm Sewer System (MS4) discharges. This document describes the motivation, procedures, and timeframe for the monitoring program, and includes a description of the City's currently established water quality monitoring stations (WQMS).

1.1 Motivation

Under the Clean Water Act, Section 303(d), state environmental agencies are required to maintain WQMS within their jurisdiction and use the collected data, following SCDHEC protocols, to issue a list of impaired waters. The City's MS4 discharges to several receiving waters which drain to impaired WQMS maintained by SCDHEC. The list of these stations is provided in Table 1. SCDHEC has developed corresponding TMDL requirements for some of these impaired water bodies, and is in the process of promulgating TMDLs for the remainder of these stations. A list of the existing TMDLs in which the City is listed as a contributor is provided in Table 2. This list also includes the Central Midlands/3 Rivers TMDL, which has an anticipated completion date of 2015. This table includes the Gills Creek, Saluda River, Congaree River, and Broad River basins. For each of these four watersheds, the City has established a monitoring and assessment plan which is contained in this report. The locations of the four watershed with established TMDLs are shown along with the City boundaries in Figure 1. This map also shows the WQMS which were impaired at the time of their corresponding TMDL promulgation.

In order to meet the Waste Load Allocations (WLA) established by these TMDLs, the City is in the process of conducting water quality monitoring on the affected streams. The goal of these monitoring efforts is to determine baseline water quality conditions in the impaired waterbodies, with an aim of assessing progress towards meeting TMDL requirements in the future. The City may edit this document at any time, and as additional TMDLs are issued by SCDHEC, the City will amend this document to include corresponding monitoring and assessment plans.

Table 1: Impaired WQMS Receiving City of Columbia MS4 Discharges, based upon the 2012 State of South Carolina Integrated Report Part I: Listing of Impaired Waters

Basin	HUC_12	County	Station	Use	Cause
Saluda	030501091403	Lexington	S-260	AL	BIO
Broad	030501060707	Richland	B-316	AL	DO
Broad	030501060708	Richland	B-280	AL	BIO
Saluda	030501100301	Richland	B-080	REC	FC
Saluda	030501100301	Richland	C-007A	FISH	HG
Saluda	030501100301	Richland	C-007F	FISH	HG
Saluda	030501100301	Lexington	CSB-001L	REC	FC
Saluda	030501100301	Lexington	CSB-001R	REC	FC
Saluda	030501100304	Richland	C-073	REC	FC
Saluda	030501100304	Richland	C-021	REC	FC
Saluda	030501100203	Richland	C-068	FISH	HG

Table 2: TMDL Summary for City of Columbia MS4 Drainage

Phase	Waterbody	TMDL	Pollutant of Concern (POC)	Relevant SCDHEC WQMS	Monitored Waterbody
I	Gills Creek	Gills Creek Watershed	Dissolved Oxygen	C-017, C-048	Gills Creek
			Fecal Coliform	C-001, C-017	
II	Saluda River	Lower Saluda River and Tributaries	Fecal Coliform	S-260	Kinley Creek
III	Congaree River	Central Midlands/3 Rivers	Fecal Coliform	CSB-001L, CSB-001R, B-080	Rocky Branch
IV	Broad River	Lower Broad River Basin	Fecal Coliform	B-280, B-834, B-337	Smith's Branch

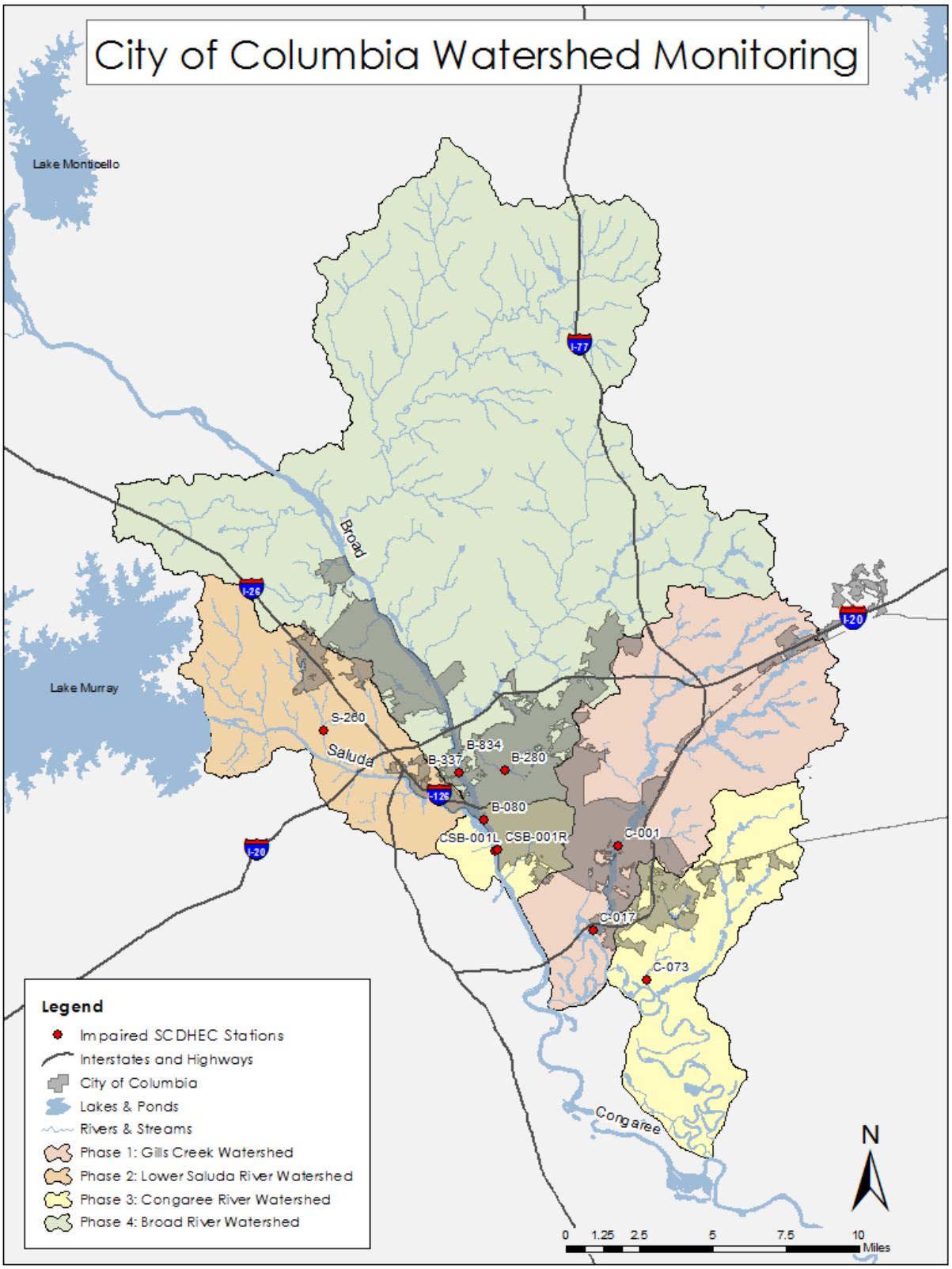

Figure 1: Watersheds Currently Included in the City's Monitoring Program, showing in red the SCDHEC WQMS which are downstream of the City's MS4 discharges and which were used as the basis for the 4 listed TMDLs

1.2 Sampling Procedures

A watershed based sampling program within its jurisdiction provides the City with the ability to conduct a broad assessment of pollutant sources, the flexibility to capture the interaction between upstream and downstream sources and impacts, and the opportunity to integrate outside data sources within its assessment. Under the City's monitoring program, a variety of sampling techniques will be used to ensure accurate and representative data are collected. These procedures may include any of the following: manual grab samples, continuous in-stream monitoring, associated flow estimation, and modeling techniques. Where applicable, guidelines established for the analysis of pollutants in water in the Code of Federal Regulations Title 40 Part 136 (40 CFR 136) will be used.

Continuous in-stream monitoring will be carried out using multi-parameter data sondes, such as the YSI 6600 series data sonde. Parameters recorded by the sensors include water temperature, pH, dissolved oxygen, specific conductivity, and turbidity. Where applicable, luminescent-based detection for dissolved oxygen (ASTM D888-09(C)) will be used to record in-stream dissolved oxygen concentrations. The same method may also be used for compliance measurement for Biological Oxygen Demand (BOD). These instruments will be calibrated regularly according to the manufacturer's standard operating procedure.

An associated estimate of flow rate will be recorded for pollutant samples. These flow rate values will be used to estimate the mass of pollutant in the stream. Flow measurements may be made by use of a weir, stage measurements and associated discharge-stage rating curves, or a velocity meter. When stage measurements are required, a Campbell Scientific pressure transducer (CS451), or similar product will be used. These measurements may be coordinated with estalbished HEC-RAS models, if available. When a discharge-stage rating curve is relied upon, discharge measurements will be taken by following USGS guidelines provided in US Geological Survey Techniques and Methods Book 3, Chapter A8, using acoustic Doppler profiler technology, such as the SonTek RiverSurveyor S5 or the SonTek FlowTracker.

Sampling will be conducted for the POC listed in the promulgated TMDL, or on an appropriate surrogate. Additional parameters may also be monitored in order to aid in the assessment of ambient water quality conditions. Grab samples will be collected according to 40 CFR 136, and will be analyzed at a state certified environmental laboratory. Sampling bottles provided by the state certified lab will be used in the collection of these samples. Where a surrogate is monitored in place of a pollutant, an appropriate model will be developed to estimate pollutant loads in the stream. Sampling and analysis procedures will not be ceased in order to avoid results that would indicate a water quality violation.

Monitoring locations for each TMDL watershed will be selected in order to ensure representative sampling for the pollutant of concern. The selected locations will be reasonably representative of MS4 contributions of the pollutant of concern. Rationale for the selection of WQMS is described for each TMDL basin in the sections below.

1.3 Program Schedule

In order to be truly representative of the system, samples will be collected at monitoring locations at least once in each of the four seasons. The four seasons are defined as indicated in Table 3. Samples will be collected at a frequency and distribution high enough to allow for a statistically significant analysis of seasonal pollutant loadings. It should be noted that the feasibility of sampling will depend upon weather

conditions; extended dry periods or inclement weather may force an alteration in the sampling schedule.

The schedule for monitoring for each phase of the City's monitoring program is included in Table 4. For each TMDL basin, monitoring will be carried out for a minimum of two years. This two year time span is reflected in the implementation timeframe listed in Table 4.

Table 3: Sampling Seasons

Season	Date Range
Fall	September 22nd – December 21st
Winter	December 22nd – March 21st
Spring	March 22nd – June 21st
Summer	June 22nd – September 21st

Table 4: Monitoring Schedule

Phase	Waterbody	Planning Timeframe	Implementation Timeframe (Start date to earliest end date)
I	Gills Creek	2012 – 2013	2013 – 2015
II	Saluda River	2013 – 2014	2014 – 2016
III	Congaree River	2013 – 2014	2014 – 2016
IV	Broad River	2014 – 2015	2015 – 2017

2 Gills Creek

2.1 Reason for Monitoring

Two TMDL documents have been issued for the Gills Creek watershed. One of these is for fecal coliform bacteria and one is for dissolved oxygen, both issued in July 2010. The two POCs, fecal coliform and dissolved oxygen, will be monitored following the procedures listed in Section 1.2.

2.2 Monitoring Schedule

The planning phase of the Gills Creek monitoring program, which included background research, site selection, and site installation, was carried out from 2012-2013. The data collection phase of the program began in 2013 and will continue for a minimum of two years, at least until 2015.

2.3 Monitoring Locations

The Gills Creek watershed contains over 70 miles of streams and lakes and encompasses approximately 76 square miles in area. The watershed includes state parks, the Fort Jackson military base, and two MS4 communities, Arcadia Lakes and Forest Acres. As the creek flows south, it passes out of Richland County into the City of Columbia, just before entering Lake Katherine. The creek leaves the City of Columbia boundary on the southern side of Bluff Road and ultimately drains into the Congaree River. Figure 2 outlines the three subwatersheds which drain to each of the established monitoring locations along Gills Creek. The fourth subwatershed highlighted in orange, furthest south on the map, is not captured by any of the City's monitoring sites.

At the outset of this project, significant effort was put into selecting monitoring locations that would meet the goals of the City's program and would also be feasible, reliable, and safe. A monitoring program can only produce high quality results if it collects high quality data, so a number of criteria were considered before final site selections were made.

The primary goal of this monitoring program is to characterize the water quality of Gills Creek and attempt to understand the drivers and processes influencing that water quality. The City is particularly eager to understand the impact that its MS4 may have on Gills Creek, in the hope that this understanding might help the City work most effectively to improve the health of this water body. This was the chief driver in selecting monitoring locations for this program. To successfully disaggregate pollutant loadings originating within the City's jurisdiction from background concentrations or upstream sources, a monitoring site was selected near the point where Gills Creek first enters the City of Columbia. Similarly, a station was placed near the downstream point where the creek leaves the City of Columbia. These two monitoring locations bracket the City, allowing for a comparison of changes in water quality that are occurring within the City boundaries. However, it should be noted that many sources outside of the authority or control of the City are also present within these boundaries, and are likely contributing to water quality changes observed within the City's jurisdiction. The City decided to take its monitoring program one step further and include a third monitoring station midway between the upstream and downstream monitoring stations, allowing for the further discretization of pollutant fluctuations in the watershed.

Before the final station locations could be selected, a number of other factors were also considered. When collecting water quality data, it is important that sampling locations be selected in order to be characteristic of the body of water. For this reason, sites needed to be installed such that monitoring equipment would not be located directly downstream of major outfalls or tributaries, or in a stagnant area of the creek. Additionally, sites had to be easily and safely accessible for regular maintenance. A final concern was property ownership, as permission needed to be secured to gain access to station equipment.

The most downstream station that the City operates, termed "GILC", is located at the site of the SCDHEC station C-017, which represents the downstream terminus of the Gills Creek TMDL watershed. As such, the City's program currently monitors the entire TMDL watershed as presented in Figure 1-1 of SCDHEC Technical Document 011N-17.

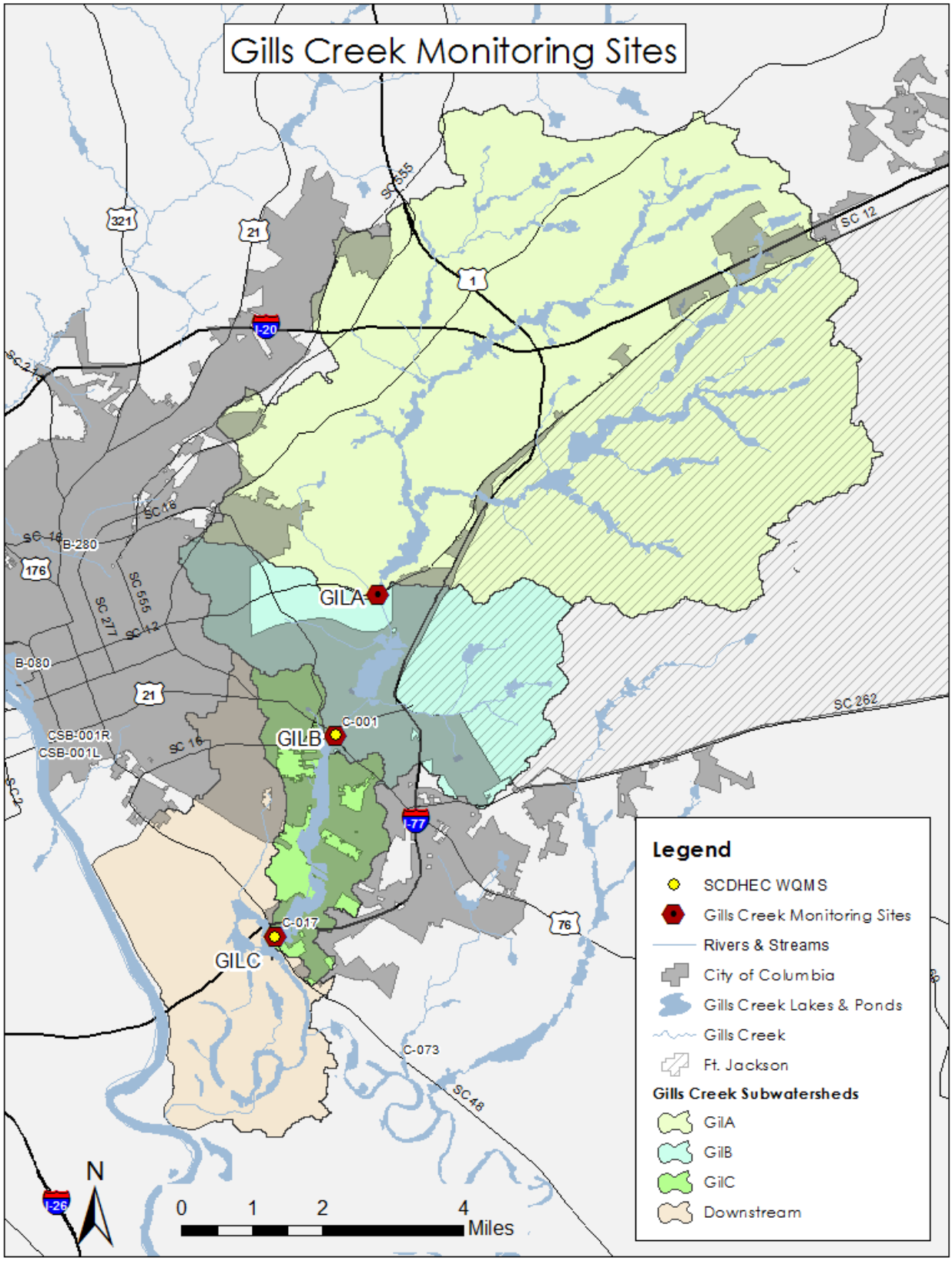

Figure 2: Gills Creek Monitoring Sites and Subwatersheds

3 Saluda River

3.1 Reason for Monitoring

One TMDL document has been issued for the Lower Saluda River watershed. This document is for fecal coliform bacteria and was issued in September 2004. The Lower Saluda is also impaired for macroinvertebrates, but no TMDL has been issued for this impairment to date. A segment of the City's MS4 drains to the Saluda River by way of Kinley Creek. In order to assess its potential contribution to the Lower Saluda fecal coliform impairment, the City decided to monitor the Kinley Creek watershed near its jurisdictional boundaries. Figure 3 shows the monitored subwatersheds along with the City of Columbia jurisdictional boundary. These stations will be monitored for the POC, fecal coliform, as outlines in Section 1.2.

3.2 Monitoring Schedule

The planning phase of the Saluda River monitoring program, which included background research, site selection, and site installation, was carried out from 2013-2014. The data collection phase of the program began in 2014 and will continue for a minimum of two years, at least until 2016.

3.3 Monitoring Locations

The Kinley Creek watershed is located in the northwestern section of the City of Columbia's jurisdiction in Lexington County. The monitored subwatershed of Kinley Creek includes 3.4 square miles of area. The creek enters the City's jurisdiction just north of Harbison Boulevard, and exits the City's jurisdiction near Seton Rd, just south of Bower Pkwy. The creek passes through one lake, Lake Quail Valley, upstream of the City's jurisdiction. Kinley Creek drains to the Lower Saluda River, which is impaired for fecal coliform and invertebrates.

Figure 3 shows the location of the two installed monitoring locations, labeled as "KINA" and "KINB". These two stations are located on either side of an area of medium and high intensity development along Harbison Boulevard. Much of the runoff from this area is diverted through a detention pond located behind the Columbiana Place shopping center.

The Kinley Creek monitoring locations were selected based upon the same criteria that were used during the Gills Creek site selection process, described in Section 2.3. The City of Columbia owns a relatively small parcel of land which contributes to the drainage area of the impaired Lower Saluda River. This area drains to Kinley Creek, which is a tributary of the Lower Saluda River. The City elected to install two monitoring stations, one where the creek first enters the area owned by the City, slightly north of Harbison Boulevard, and the second near the location where the creek passes out of the City's jurisdiction. An examination of differences in water quality between these two sites should indicate the water quality changes that are occurring in Kinley Creek within the City-owned drainage area. However, it should be noted that activities outside of the authority of the City are occurring within the monitored subwatershed; the water quality impacts of the different sources cannot be parsed from one another.

The Kinley Creek monitoring program captures a drainage area with well over 25% of that area accounted for by the City's MS4.

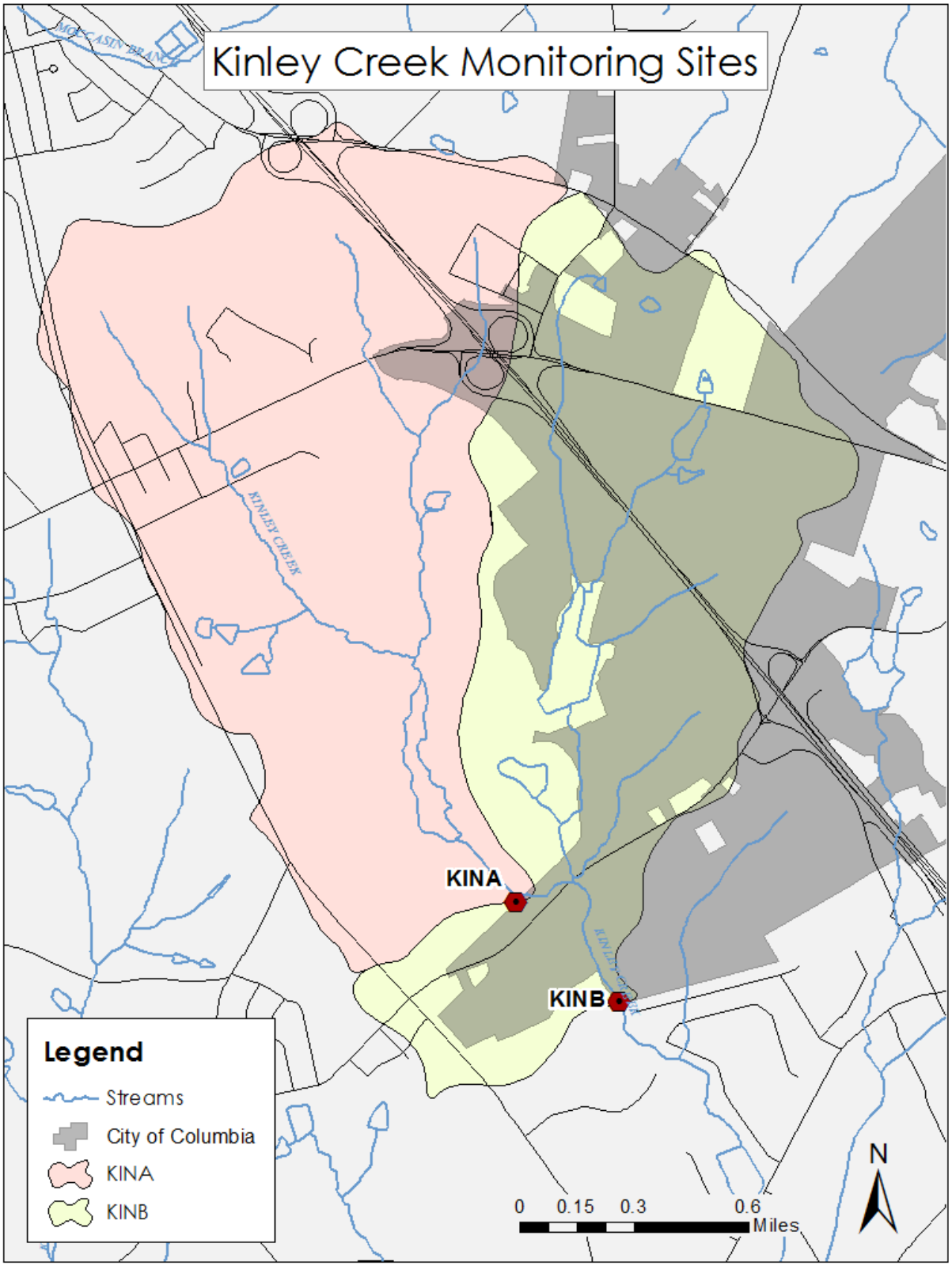

Figure 3: Kinley Creek Monitoring Sites

4 Congaree River

4.1 Reason for Monitoring

The Congaree River is impaired for E. coli, and a TMDL for this impairment, titled the Central Midlands/3 Rivers TMDL, is currently under development. Land owned by the City drains to Rocky Branch, which is a tributary of the Congaree River entering the river shortly downstream of the impaired SCDHEC station. Due to the sensitive nature of the water quality near the confluence of Rocky Branch and the Congaree River, and the branch's central location within the City of Columbia, the City determined to establish two monitoring locations along Rocky Branch. These locations will be monitored for the POC, E. coli, when the TMDL for this watershed is issued.

4.2 Monitoring Schedule

The planning phase of the Congaree River monitoring program, which included background research, site selection, and site installation, was carried out from 2013-2014. The data collection phase of the program began in 2014 and will continue for a minimum of two years, at least until 2016.

4.3 Monitoring Locations

The monitored portion of the Rocky Branch watershed includes an area of 3.8 square miles. The headwaters of the watershed extend up to include segments of Two Notch Road and Millwood Avenue. The downstream terminus of the watershed is located along Olympia Avenue. This watershed is located almost entirely within the City limits, and includes the 5-points shopping and dining area.

The Rocky Branch monitoring site selection process was carried out in a manner very similar to that of the Gills Creek and Kinley Creek watersheds. Sites were selected with the goal of isolating the water quality changes that occur within the City's jurisdiction, while recognizing that these changes can only be attributed in part to activities under the City's authority to control. Factors such as safety, feasibility, and access also had to be considered in the site selection process.

Figure 4 shows the location of the two selected sites along Rocky Branch, as well as the subwatershed delineations draining to each site and the City boundary. As this figure shows, the upstream site, given the station ID "ROCA", is surrounded by City-owned property. The headwaters of Rocky Branch are fully contained within the City limits; the ROCA site was selected because of its location shortly downstream of the 5-points area, within Maxcy Gregg Park. This station should allow for an analysis of the water quality in a very flood prone area of Rocky Branch. The second site, given the station ID "ROCB" was selected because it is located near the downstream boundary of the City's jurisdiction. This station should provide an indication of the water quality in Rocky Branch as the stream leaves City boundaries.

Both the ROCA and ROCB monitoring stations monitor subwatersheds with well over 25% of the contributing area belonging to the City's MS4. Indeed, the ROCA station monitors a watershed that is entirely within the City's boundaries. As such, these stations should provide a good representation of the City's influences on water quality.

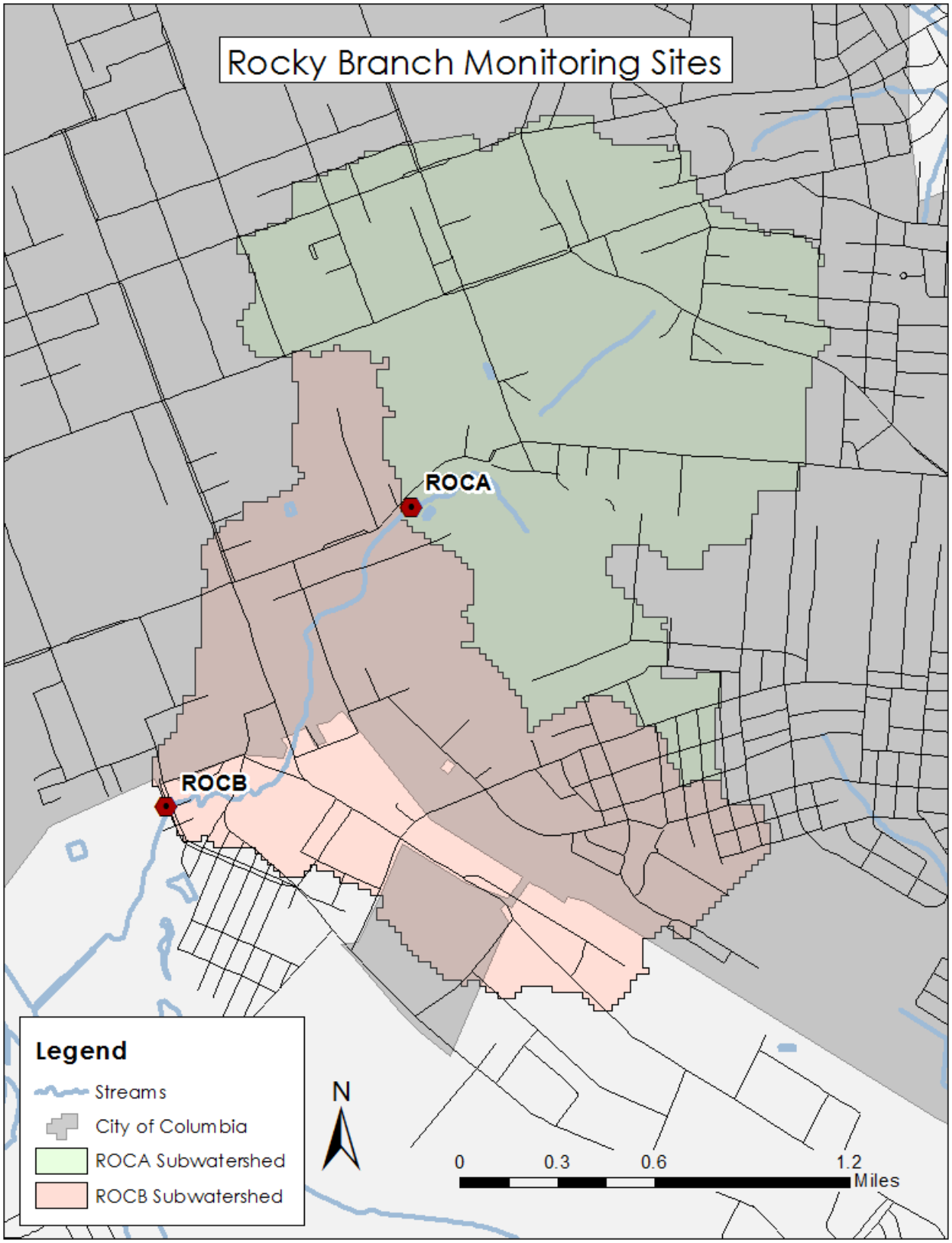

Figure 4: Rocky Branch Monitoring Sites

5 Broad River

5.1 Reason for Monitoring

The Lower Broad River has an established TMDL for fecal coliform bacteria. The majority of the City's MS4 property within this TMDL watershed drains to the Smith Branch tributary. For this reason, the City decided to establish a monitoring program on Smith Branch to characterize any impacts the City's MS4 may have on the fecal coliform impairment on the Lower Broad River. Figure 5shows the monitored subwatersheds along Smith Branch in relation to the TMDL boundary. These stations will be monitored for fecal coliform according to the procedures outlined in Section 1.2.

5.2 Monitoring Schedule

The planning phase of the Congaree River monitoring program, which includes background research, site selection, and site installation, will be carried out from 2014 - 2015. The data collection phase of the program will begin in 2015 and will continue for a minimum of two years, at least until 2017.

5.3 Monitoring Locations

The monitored portion of the Smith Branch watershed encompasses an area of 6.6 square miles. The headwaters of this watershed capture runoff form the Palmetto Health Richland medical complex. The downstream terminus of the monitored watershed to located where Smith Branch crosses Clement Road. At this point, the creek leaves the City's jurisdictional boundary.

The two monitoring stations on Smith Branch were termed "SMIA" and "SMIB" and are shown in Figure 6. The site selection process for setting these locations was similar to the process carried out in the City's Gills Creek, Kinley Creek, and Rocky Branch monitoring programs, and included consideration of station and personnel safety, the need for a representative stream location, and also a desire to capture a significant portion of the City's MS4 area within the Lower Broad TMDL watershed. In Figure 5 below, the monitored watershed is shown along with the TMDL boundary, and illustrates the appropriateness of monitoring Smith Branch with the goal of understanding the City of Columbia MS4's impact on the Lower Broad River's impaired water quality.

The monitored subwatersheds capture runoff from an area that is almost entirely comprised of the City's MS4 territory.

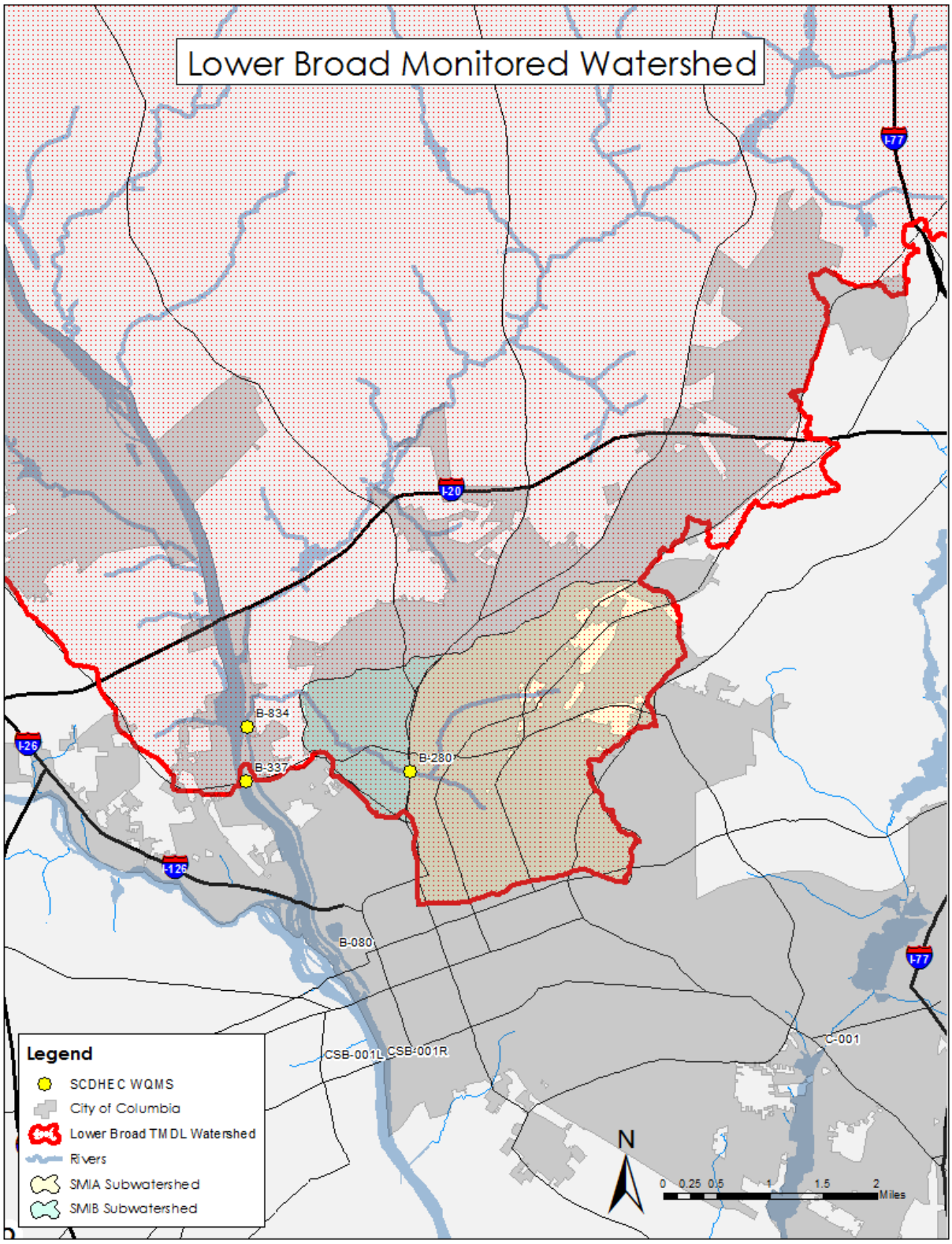

Figure 5: Lower Broad TMDL Watershed, Monitored Area. TMDL Watershed Area taken from SCDHEC 2014 Approved TMDL Watershed GIS Data Clearinghouse

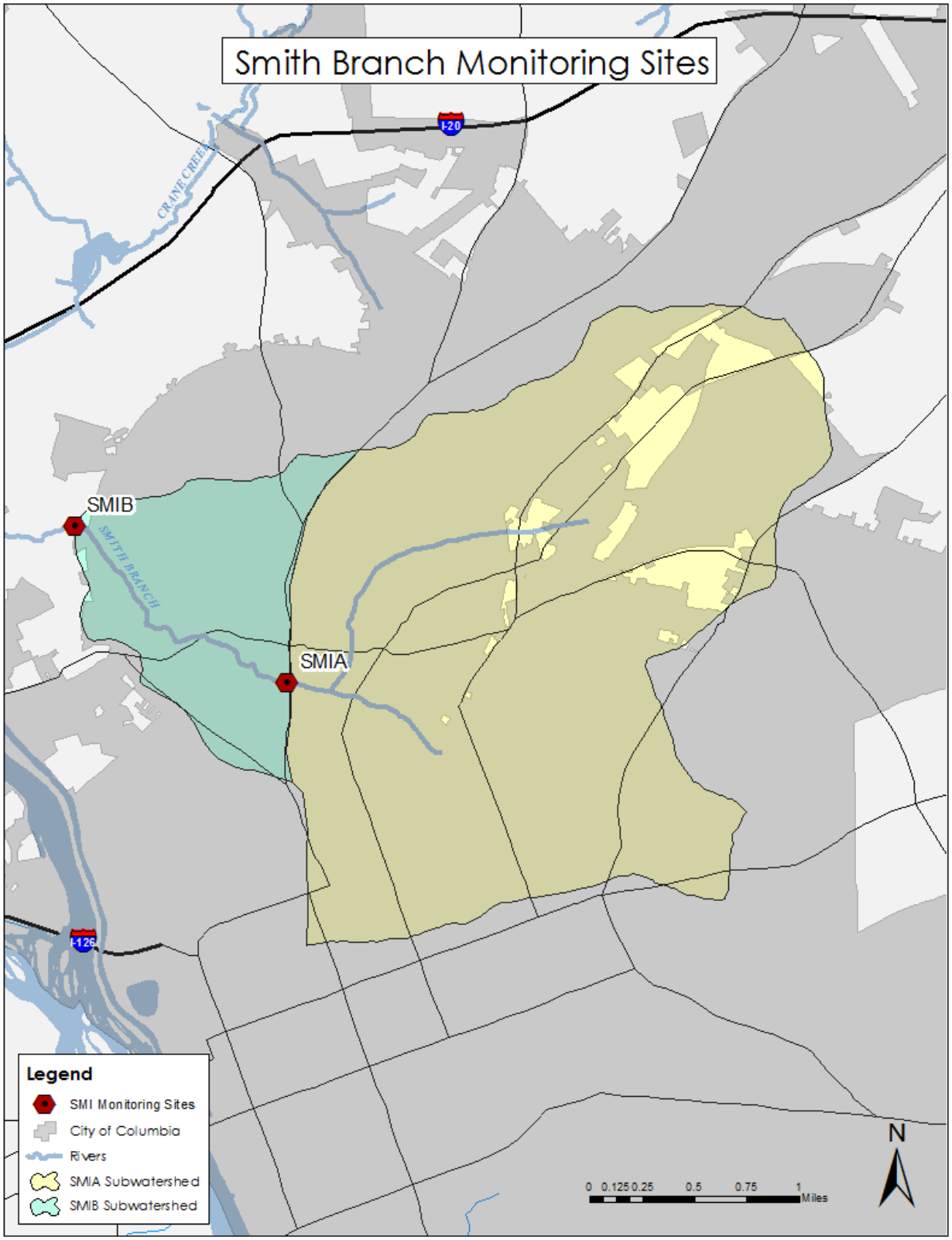

Figure 6: Smith Branch Monitoring Locations